1. Description of Watersheds Addressed by the EAWSWRP

The project watershed boundary lies within Humboldt County and encompass the City of Eureka and unincorporated areas of Humboldt County including Myrtletown, Fields Landing, Cutten, Ridgewood, Brainard, and Indianola (Figure 1-1). The upper portion of the watershed is generally less populated compared to the lower portion of the project watershed. The hillslope areas of the upper region are primarily occupied by timber production and harvesting activities, while the lower portions are typically more urbanized. Surface waters within the project watershed drain to Humboldt Bay, which is the largest estuary in California north of San Francisco. Humboldt Bay offers typical coastal values of an estuarine embayment as well as a major shipping center and an extensive commercial oyster industry (Dyett and Bhatia 2002).

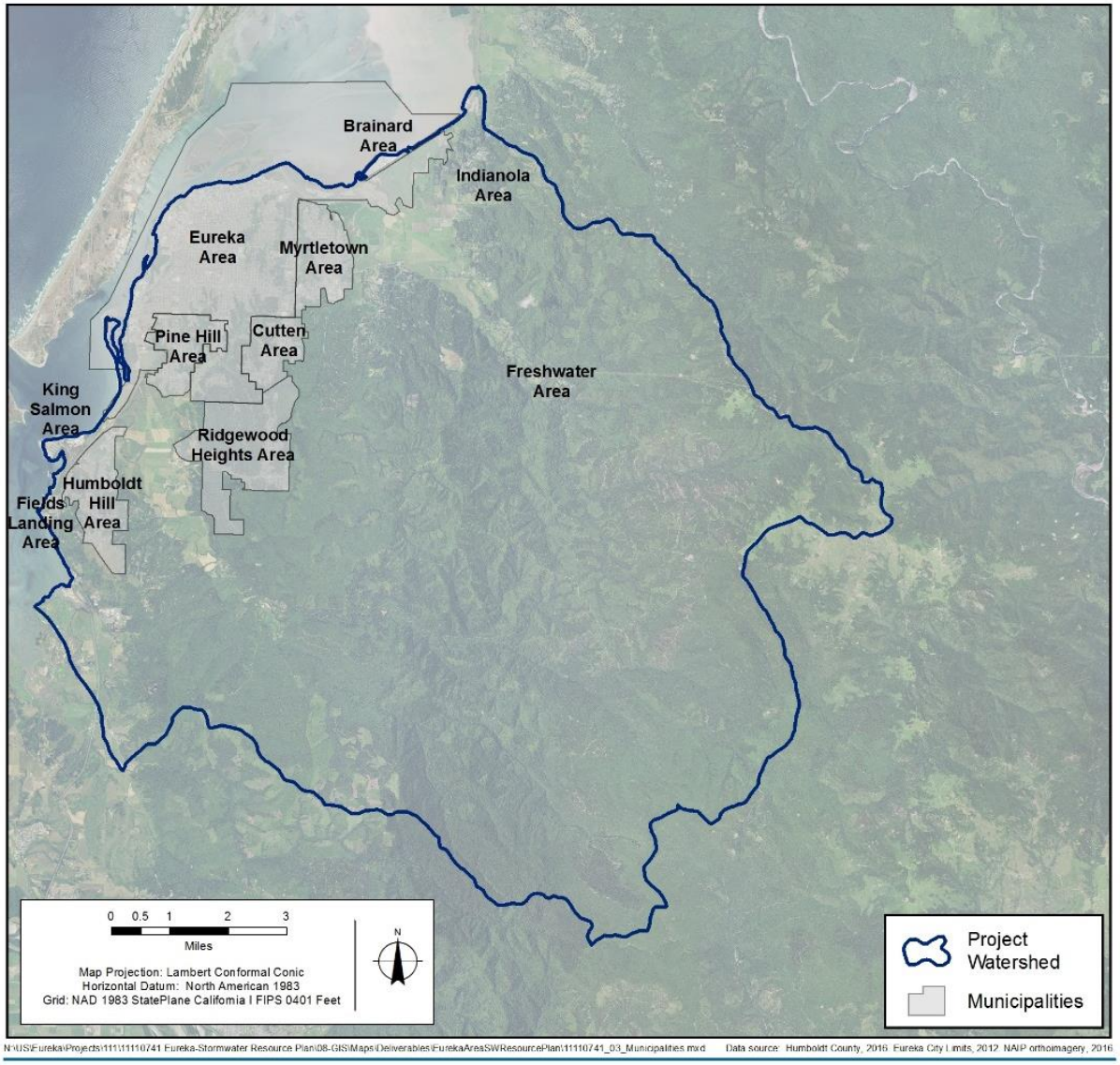

Figure 1-1. Municipalities within the Project Watershed

1.1 Previous Planning and Data Collection Efforts

To utilize previous planning and watershed characterization efforts, an extensive literature and data review was conducted. Relevant and available reports, water quality studies and data, water quantity data, and GIS data known to exist were identified and reviewed. A summary of the documents and datasets collected is provided in **Error! Reference source not found.**. A brief summary of relevant, existing plans and studies within the project watershed is provided in the following sections.

1.1.1 Regional Plans

The relevant regional plans addressed below are the North Coast Integrated Regional Water Management Plan (NCRP 2014) and the North Coast Water Quality Control Plan (NCRWQB 2011). The project watershed is one of many watersheds addressed in these two plans. A brief summary of each plan is provided in the following sections.

1.1.1.1 North Coast Integrated Regional Water Management Plan

The North Coast Integrated Regional Water Management Plan (NCIRWMP) is planning document that discusses major water-related issues and objectives within the North Coast region. The plan provides a centralized and collaborative framework for addressing local, regional, and statewide water resource priorities (NCRP 2014). The NCIRWMP was developed by the North Coast Resource Partnership (NCRP). The NCRP is comprised of the seven North Coast counties and tribes within the NCRWQCB watershed boundary. The NCIRWMP is supported by over 100 agencies, special districts, Tribal organizations, non-governmental organizations, watershed groups, and other stakeholders. The overarching goals of the NCIRWMP are beneficial uses of water, salmonid enhancement, energy independence, climate adaptation/mitigation, economic vitality, local autonomy, intraregional cooperation, and adaptive management. The plan outlines a project application, review and selection process. Details for selected projects are available on the NCRP website (NCRP 2013).

1.1.1.2 Water Quality Control Plan for the North Coast Region

The North Coast Regional Water Quality Control Plan (Basin Plan) is a comprehensive document that describes the existing and potential beneficial uses of the waters within the region. The plan serves a regulatory tool for the Regional Water Board and other agencies in their permitting and resource management activities. It is also utilized as an educational and reference document for stakeholders and members of the public. The Action Plan outlined in the Basin Plan for Humboldt Bay includes: (1) discharger surveillance and monitoring, (2) review and assessment of land use activities, and (3) continued coordination with other state and local agencies with various responsibilities with regards to Humboldt Bay (NCRWQCB 2011).

1.1.2 Local Planning Documents

Of the plans and studies that have been conducted within the project watershed, the most relevant documents are summarized below. Information from other studies within the project watershed area can be found in **Error! Reference source not found.**.

1.1.2.1 City of Eureka Phase II NPDES Storm Water Management Plan

The City of Eureka's Storm Water Management Plan was developed to comply with the Federal Storm Water Phase II Final Rule, which requires operators of small municipal separate storm sewer systems (MS4s) to obtain coverage under a National Pollutant Discharge Elimination System (NPDES) permit.

The plan provides a description of the area's watershed, storm sewer system, priority pollutants, and target audiences. Individuals and departments accountable for the various implementation responsibilities are identified. As required by the Phase II rule, the SWMP includes six minimum control measures: (1) public education and outreach, (2) public involvement/participation, (3) illicit discharge detection and elimination, (4) construction site runoff control, (5) post construction storm water management, and (6) pollution prevention/good housekeeping practices for municipal operations (W&K 2005).

1.1.2.2 Eureka Strom Drain Master Plan

The Eureka Storm Drain Master Plan was developed for the City to map and evaluate the storm sewer system. Key elements of the plan include: design criteria to be used for sizing drainage improvements, identified problem areas and recommendations, a method for project prioritization, and potential methods for funding projects (W&K 1996). Although the plan was developed in 1996, City staff continue to use the document to identify storm sewer system improvements.

1.1.3 TMDLs

A Total Maximum Daily Load (TMDL) is a planning and management tool used to assess and protect water quality in a given watershed. A TMDL is generally required for water bodies that are placed on the on the list of impaired waters, as defined by Section 303(d) of the federal Clean Water Act. Section 303(d) requires that states develop a list of water bodies that do not meet water quality standards once technological feasibility is considered. In California, once a water body is placed on the 303(d) list, there are five steps to develop a TMDL (SWRCB 2017):

1. Involve stakeholders
2. Assess the water body
3. Define the total load and develop allocations
4. Develop an implementation plan
5. Amend the Basin Plan

Within the project watershed, a total of five water body segments are on the 303(d) Impaired Water Bodies List (Figure 1-2). Further discussion of the impaired water bodies and TMDL status is provided in 2.1.2.1.

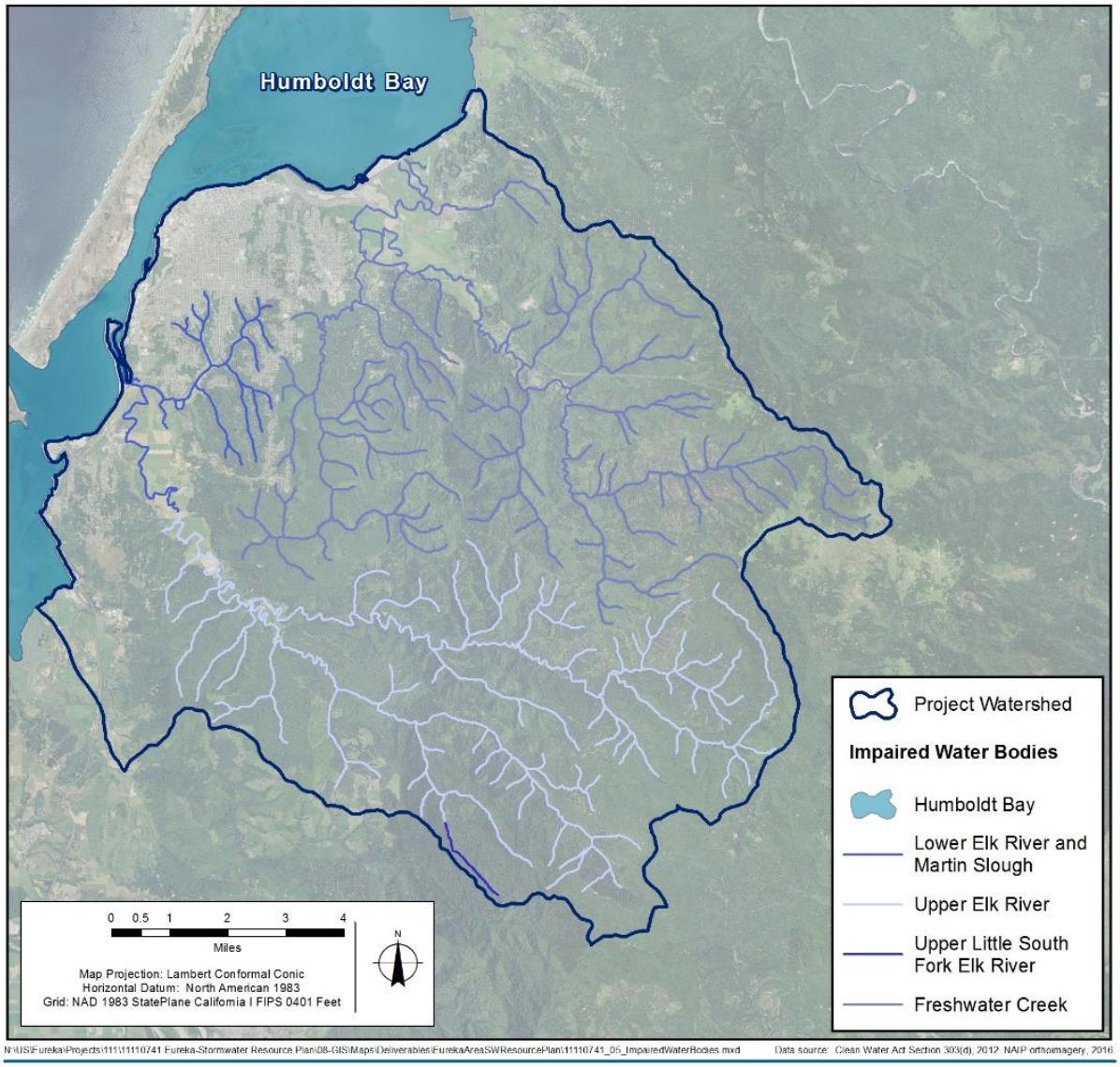

Figure 1-2. Water Bodies on the 303(d) Impaired Water Bodies List

1.1.4 Data Gap Analysis

The initial data gap analysis conducted for this SWRP indicated that previous efforts have resulted in a large set of studies and datasets that are useful for the development of this document. Although data from previous efforts will be utilized, data collection in portions of the watershed will be needed. A memorandum summarizing the data gap analysis is included in **Error! Reference source not found.**.

1.1.5 Data Collection

This section will include a summary of the data collection efforts for this SWRP.

1.1.6 Stormwater Resource Plan GIS

This section will include a summary of the GIS efforts for this SWRP.

1.2 Watershed and Subwatersheds

The project area watershed covered by this SWRP is located within the Eureka Plain Hydrological Unit and covers approximately 80,500 acres. The subwatershed areas (Figure 1-3) are CalWater-defined watersheds and include the following:

- Cloney Gulch
- Fay Slough
- Little Freshwater Creek
- Martin Slough
- Ryan Slough
- Upper Freshwater Creek
- W. Side Eureka
- Pine Hill
- Fields Landing
- Lower S. Fork Elk River
- Upper S. Fork Elk River
- Lower N. Fork Elk River
- Upper N. Fork Elk River
- Lower Elk River

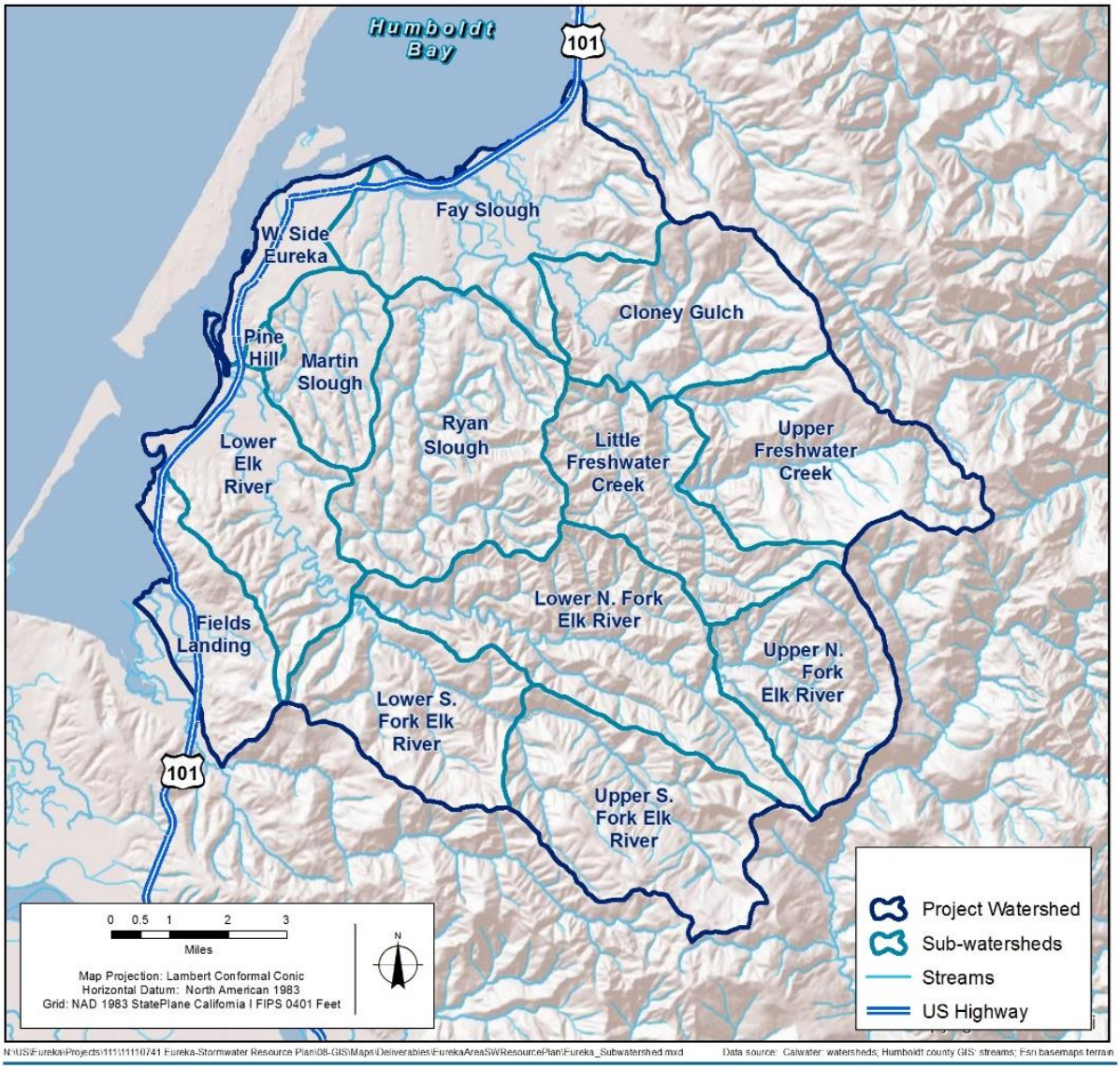

Figure 1-3. Project Watershed and Sub-watersheds

These subwatersheds were selected as the focus of the SWRP for several reasons. The small size of the subwatersheds, which ranges from approximately 230 to 9,435 acres, lends itself to quantitative analysis of storm water runoff patterns while the large project watershed boundaries allow for comprehensive and integrated storm water management with a multi-benefit approach. The watershed downstream channels all flow through the most urbanized and highly populated regions within the Eureka Area. The storm water and wastewater infrastructure between the City and the County/HCSD is connected, and the project watershed area allows the entities to coordinate planning at a higher level than they have historically. The collaboration across local and regional governments, utilities, and stakeholders facilitates a cooperative approach to assessing storm water management needs. Neighboring watersheds do not have the same urban

characteristics as the proposed watersheds in the SWRP and are therefore not covered by this SWRP.

1.3 Surface Water Resources

Water bodies within the project watershed (Figure 1-4) support a variety of beneficial uses including municipal and domestic supply; agricultural supply; industrial service supply; groundwater recharge; freshwater replenishment; navigation; water contact recreation; non-contact water recreation; commercial and sport fishing; cold freshwater habitat; wildlife habitat; rare, threatened, or endangered species; marine habitat; migration of aquatic organisms; spawning, reproduction, and/or early development; estuarine habitat; aquaculture and Native American culture (NCRWQCB 2011). Surface waters are discussed further below, broken out by the two major drainages and other small creeks that drain to Humboldt Bay. The water quality concerns that pose risks to these water bodies is also included in this section.

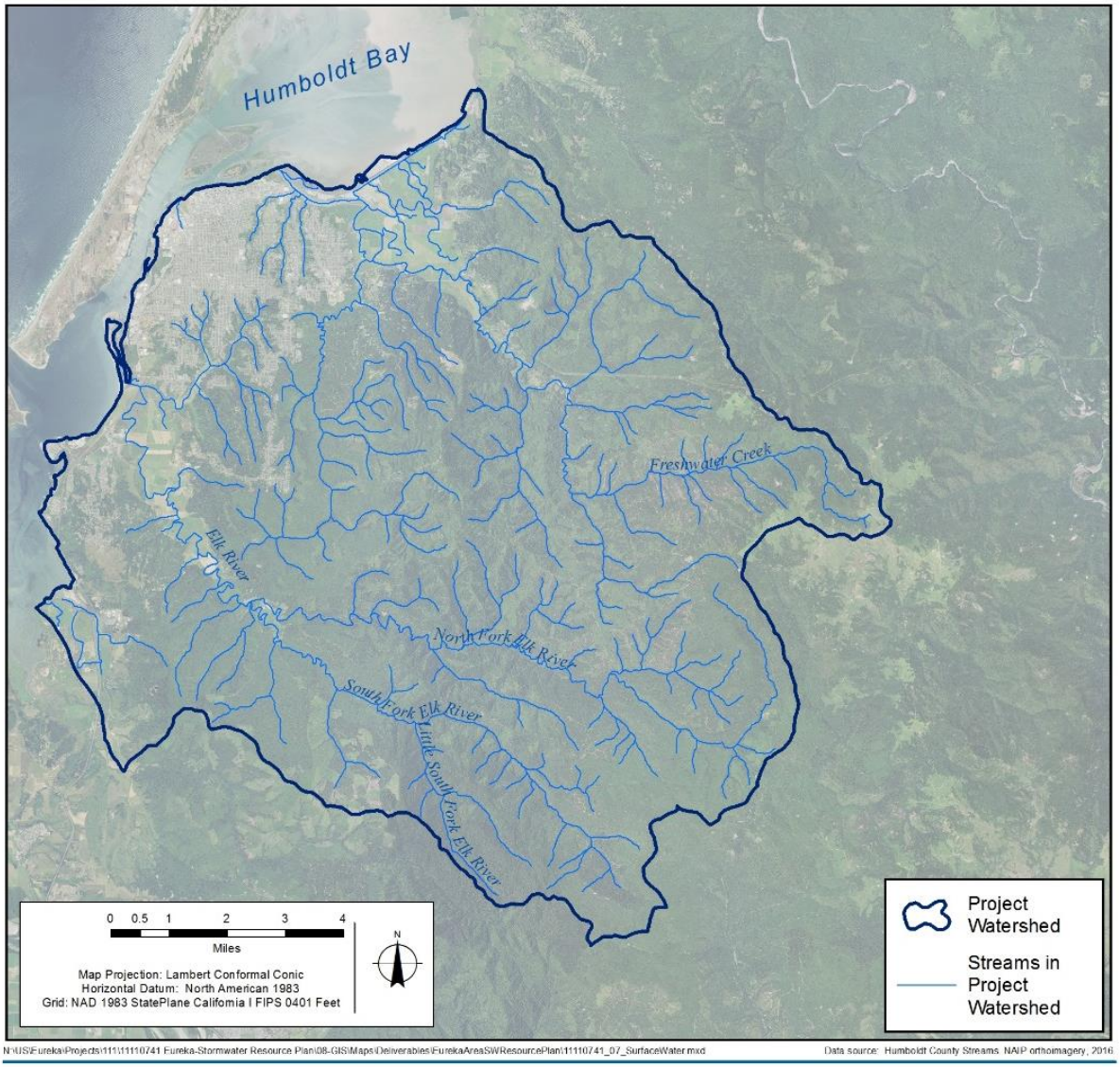

Figure 1-4. Surface Waters in the Project Watershed

1.3.1 Elk River and Freshwater Creek

The two main surface waters, Elk River and Freshwater Creek are listed as 303(d) impaired waters due to sedimentation and siltation (SWRCB 2015). Although watershed boundaries vary by study, the typical sub-watersheds included in the Elk River and Freshwater Creek watersheds are provided in Table 1-1. An Adopted Action Plan for the Upper Elk River Sediment TMDL has been developed (NCRWQCB, 2016) and a sediment source assessment was completed for the Freshwater Creek TMDL area (PWA 2006). Historical, and to a lesser extent, ongoing timber harvesting practices and road construction have contributed to increased levels of sediment and silt in streams, as well as non-point source runoff (Humboldt County 2017, PWA 2006). Other sedimentation, particularly for the Freshwater Creek sub-watersheds is a result the fine-grained

nature of the underlying geologic units (WPN 2003). Large amounts of natural sediment are typical of wet and tectonically active areas underlain by weak rocks (HWISRP 2002).

Table 1-1. Grouped CalWater Subwatersheds

Watershed	CalWater Subwatershed(s)
Elk River	Upper N. Fork Elk River, Upper S. Fork Elk River, Lower N. Fork elk River, Lower S. Fork Elk River, Lower Elk River, and Martin Slough
Freshwater Creek	Upper Freshwater Creek, Little Freshwater Creek, Cloney Gulch, Fay Slough, and Ryan Slough

1.3.2 Humboldt Bay

In addition to sediment and silt, other water quality issues in Humboldt Bay include dioxins (EviroNet and ENVIRON 2003) and fecal coliform (Humboldt Bay Shellfish TAC 2003). The presence of these constituents has previously led to the shellfish harvesting closure, which ultimately led to the formation of a shellfish Technical Advisory Committee (Humboldt County 2017).

Low levels of dioxins detected in the Humboldt Bay are suspected to have persisted in soil on the sites of former lumber mills (EviroNet and ENVIRON 2003, Humboldt Baykeeper 2017). Dioxin equivalent results studies assessed by the SWRCB and the Regional Water Board demonstrated that 25 out of 70 fish or shellfish tissue samples exceeded the 0.3 ng/kg Office of Environmental Health Hazard Assessment screen value (NCRWB 2010). Dioxin toxic equivalents are used as a measurement for dioxin contamination of waterbodies. Dioxin is listed as a pollutant that impairs the Humboldt Bay and renders it an Impaired Water Body under Section 303(d) of the CWA. Dioxins are extremely toxic, very long-lasting compounds that can cause reproductive damage and cancer. These compounds bind to sediments, slowly moving through the Bay on tides. Dioxins in Humboldt Bay bioaccumulate in fish and shellfish, becoming more concentrated as they move up the food chain, potentially harming humans and wildlife alike (Humboldt Baykeeper, 2017).

Fecal coliform testing in and around Humboldt Bay suggested that Fay and Ryan's Slough, and eight of sixteen sampling locations in Eureka experience elevated fecal coliform concentrations during dry weather, and Fay Slough and Elk River, and four other locations within Eureka appear to have a constant source of fecal coliform during wet weather (Humboldt Bay Shellfish TAC 2003). Nonpoint sources that may contribute to an increase in fecal matter presence include activities by domestic livestock, wildlife, migratory fowl, septic systems, horticultural runoff, urban runoff, marina and boating activities, Cal-Trans and railroad maintenance related activities rainfall related releases (Humboldt Bay Shellfish TAC 2003).

1.3.3 Priority Pollutants

The priority pollutants within the project watershed were determined based on statewide priority pollutants, pollutants that affect 303(d) listed water bodies, and common pollutants of concern.

(Table 1-2). Pollutants were categorized into primary and secondary pollutants. Primary pollutants are those driven by a regulatory framework while secondary pollutants are those that are considered common pollutants of concern in certain areas.

Table 1-2. Pollutants of Concern within the Project Watershed

Pollutant	Primary Pollutant	Location(s)	Source(s)
Sediment	X	Elk River, Freshwater, City of Eureka	NCRWQCB 2016, PWA 2006, W&K 2005
Nutrients		City of Eureka	W&K 2005
Trash	X	Countywide	SWRCB 2017b
Indicator bacteria	X	Lower mainstem Elk River, Martin Slough, Humboldt Bay	SWRCB 2017a, NCRWQCB 2011
Dioxin toxic equivalents	X	Humboldt Bay	SWRCB 2015b
Polychlorinated Biphenyls	X	Humboldt Bay	SWRCB 2015b
Pesticides		City of Eureka	W&K 2005
Hydrocarbons		City of Eureka	W&K 2005

1.4 Groundwater Resources

Groundwater levels in the Humboldt region are typically relatively high due to coastal influences (salt water intrusion) and a wet climate. In unconfined portions of the alluvium, groundwater occurs at depths less than ten feet (DWR 2004). Groundwater levels are therefore likely to affect surface water and storm water runoff infiltration. The Eureka Plain groundwater basin is defined as part of the California Coastal Basin Aquifer and is the only groundwater basin identified in the project watershed boundaries (Figure 1-5).

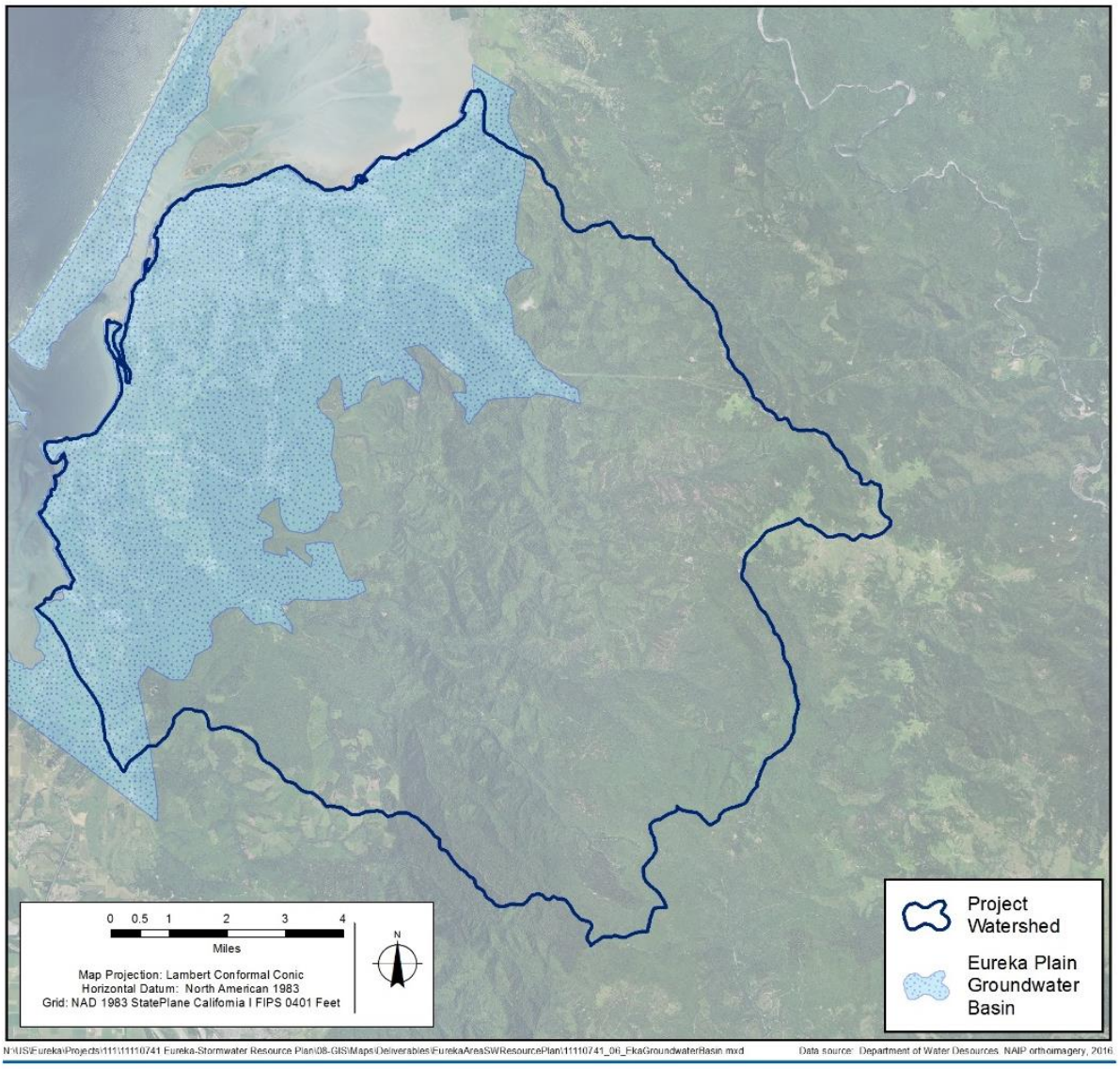

Figure 1-5. Groundwater Basin in the Project Watershed

The basin is approximately 37,400 acres (CA DWR 2004). It is composed of Quaternary alluvium and deposits of the Hookton Formation underlain by non-marine Wildcat series deposits (CA DWR 2004). Pliocene Hookton formation, which underlies approximately 70 percent of the basin, is the primary water-bearing formation. Holocene dune sand, which occurs along the coast, and alluvial deposits located southeast of Arcata Bay and along the Elk River also provide water storage (CA DWR 2004). Precipitation and seepage from surface waters are the primary source of recharge, with some lateral groundwater movement from adjacent formations (CA DWR 2004). The basin is estimated to yield approximately 6,100 acre-feet per year (CA DWR 2004). The groundwater within the Eureka Plain basin is characterized as calcium-magnesium type water with TDS concentrations ranging from 97 to 460 mg/L (CA DWR 2004). Other localized impairments to groundwater as drinking water include high boron, iron, manganese, and phosphorus (CA DWR 2004). Saltwater

intrusion also poses a threat to groundwater quality within the basin (Humboldt County, 2017). Agencies that operate within the basin include the City of Eureka, HCSD, HBMWD, and Manila CSD (CA DWR 2004).

1.5 Water Supply

In general, the watershed is located in an area with an abundance of water supplies. However, understanding how water is supplied is necessary for an integrated storm water management approach.

1.5.1 HBMWD, the City of Eureka, and HCSD

Water supply in the project watershed is provided primarily by HMBWD for the urban areas and private wells in rural areas. HBMWD extracts water from the underlying aquifer beneath Mad River via Ranney Collectors and averages approximately 10 million gallons per day (11,000 AFY) (HMBWD 2016). HMBWD operates a regional water system and provides service at a wholesale level (HMBWD 2016). Of the municipalities, Eureka and HCSD are located in the project watershed. Unlike HCSD, the City of Eureka maintains water rights to Mad River water equivalent to 6,499 AFY (5.8 MGD). Under the agreement between the HBMWD and the City of Eureka, the deliveries from HBMWD to the City of Eureka are considered to be deliveries of the City's water, emanating from its own water rights not those of HBMWD. As of 2007, HCSD purchased approximately one third of its potable water from HBMWD, one third from its own wells at the base of Humboldt Hill and Spruce Point area, and one third from the City of Eureka, which also originates from HBMWD (W&K 2007, Freshwater Environmental Services 2011).

HCSD owns and maintains three deep (400 foot plus) wells located at the base of Humboldt Hill in the Eureka Plain Groundwater Basin (Freshwater Environmental Services 2016). In 2010, a total of approximately 591 million gallons of water were distributed by HCSD (Freshwater Environmental Services 2011).

1.5.2 Private Water Systems

The remaining residents are served by private water systems including wells, springs and other surface water sources (W&K 2007). Private wells, particularly within the Elk River and Freshwater Valleys, experience poor drinking water quality and have requested public water through HCSD (W&K 2008). According to the USGS, groundwater quality within the Eureka Plain is acceptable for most uses; however, dissolved iron concentrations may exceed the US EPA's secondary drinking water standard of 300 ug/L, and the ionic and bacterial levels make the groundwater unsuitable for domestic or municipal use (Humboldt County 2017).

1.6 Wastewater Services

Wastewater is handled in one of two ways within the project watershed: conveyance to and treatment at the Elk River Wastewater Treatment Plant, or via on-site septic systems.

1.6.1 The Elk River Wastewater Treatment Plant

For the majority of urban areas, wastewater is conveyed to the Elk River Wastewater Treatment Plant (WWTP), run by the City of Eureka (W&K 2008). Areas located within the City and HCSD are shown in Figure 1-6. A total of approximately 45,000 people are served by the WWTP (City of Eureka, 2017). In winter months, high levels of inflow and infiltration (I&I) cause the WWTP and portions of both HCSD's and Eureka's collection systems to reach near capacity (W&K 2008).

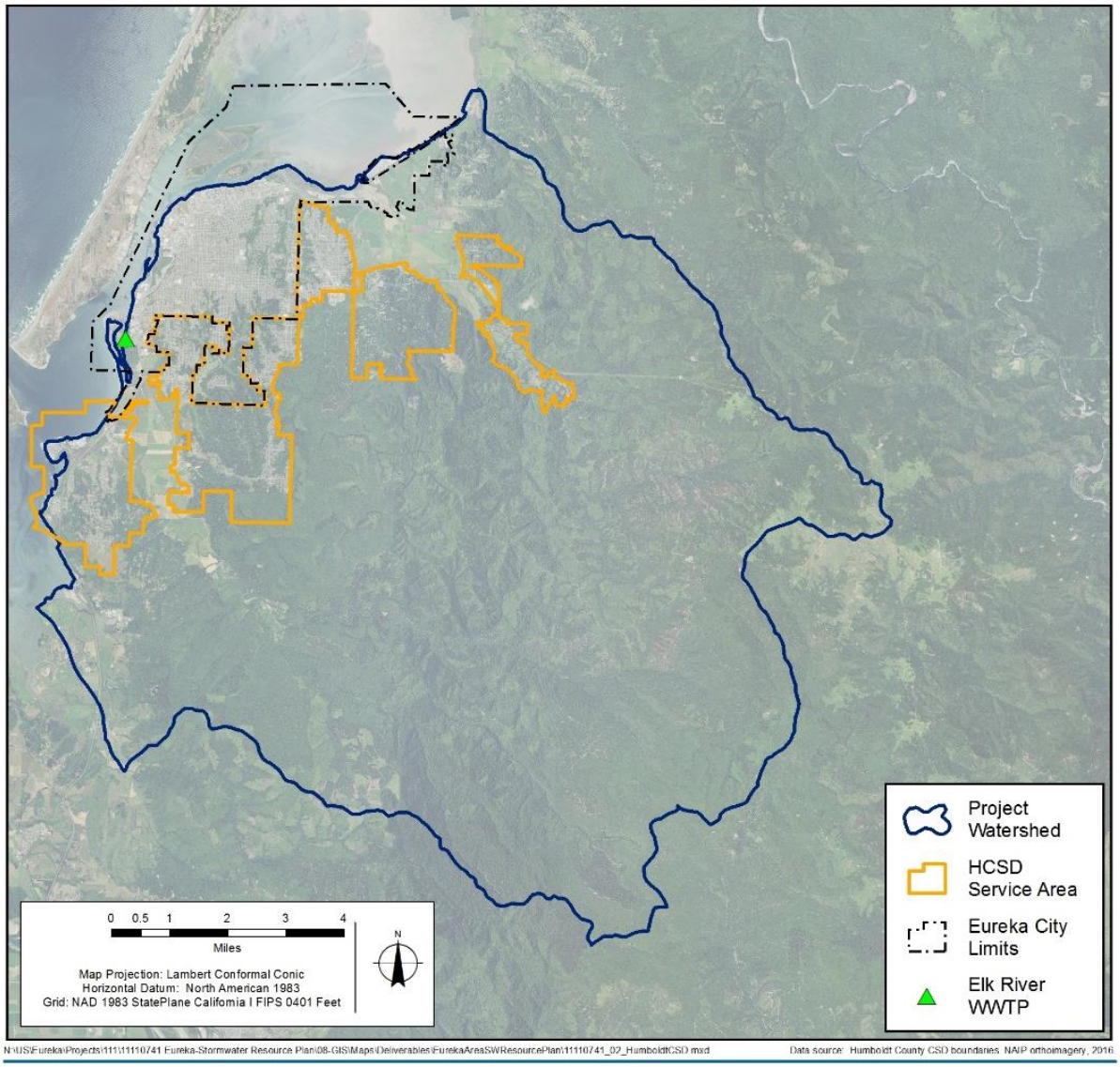

Figure 1-6. Areas Served by Elk River WWTP in the Project Watershed

1.6.2 On-site Wastewater Systems

Most rural areas within the county have on-site septic systems. A septic system is a biological method of household sewage treatment that can be very effective when it has been carefully designed and installed and then is properly used and maintained. Septic systems are designed to provide partial treatment of the sewage, with disposal to the soil in such a manner that the sewage stays under the ground and is further treated by soil organisms so that contaminants do not reach groundwater or streams. While these systems can work effectively, high groundwater levels can significantly reduce their performance. Once in the groundwater pollutants can travel up to 100 times the distance in unsaturated soils before achieving the same level of treatment. It is therefore

necessary to identify existing and potential future on-site septic system locations to appropriately implement LID features in the rural areas.

1.7 Land Use

The quality of storm water runoff through a watershed is predicated on the land use practices within the drainage area. The project watershed is comprised of mixed land uses (Figure 1-7), which can be described in three general sections based on relative elevation. The headwaters and upper portion of the watershed are primarily comprised of privately-owned second and third growth redwood forest. The majority of the middle watershed is low density rural residential and agriculture. The lower watershed is primarily within the City of Eureka limits, which is mixed land use that is predominately residential and commercial parcels with public parks and privately owned fields. Light industrial land use exists along the Bay.

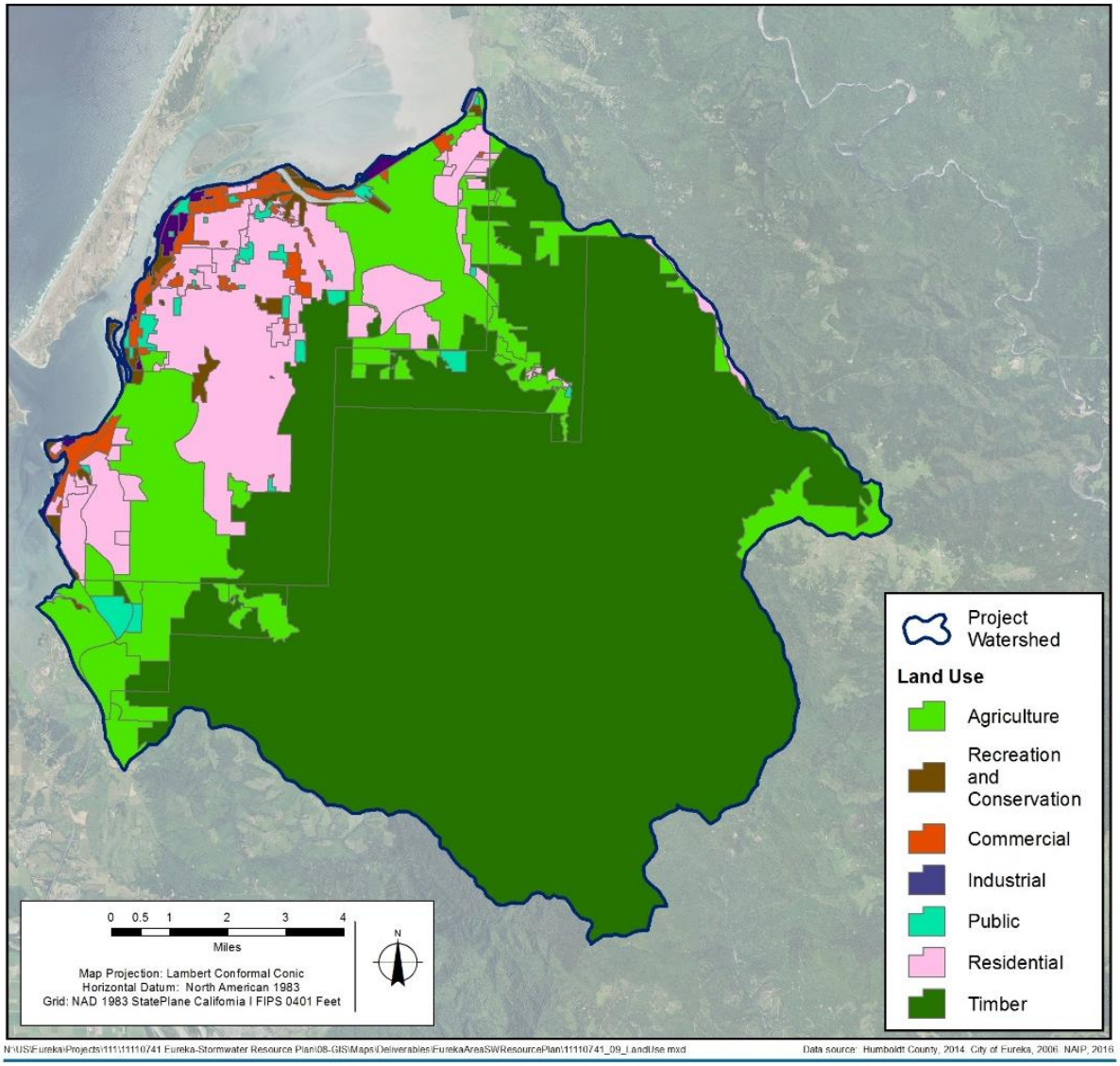

Figure 1-7. Land Uses within the Project Watershed

1.8 Native Habitats

Humboldt County offers a variety of outdoor recreational opportunities due to its abundance of parks and open space. For the county, more than twenty percent of the 2.3 million acres are protected open space, forests, and recreation areas (Dyett and Bhatia Urban and Regional Planners 2002). The rural, upland areas are characterized by coniferous forest dominated by coastal redwood. Other tree species in the project watershed include Douglas fir, grand fir, western hemlock, Sitka spruce, tanoak, and Pacific madrone, and red alder (Coastal Conservancy 2013; WPN 2003). Understory herbaceous species include the western swordfern, evergreen huckleberry, and red huckleberry (Coastal Conservancy 2013; WPN 2003). The lower portion of the watershed encompasses tidelands and marshes, which are integral to many species of waterfowl and shore

birds, both for feeding and nesting. Cultivated lands within the project watershed also provide supplemental food for many birds, including small pheasant populations. The tidal areas provide habitat for invertebrates and nursery areas for forage fish, game fish, and crustaceans (SWRCB 2014).

The project watershed provides habitat to a variety of wildlife species, including species that are a candidate for listing or listed as threatened under the Endangered Species Act. Marbled murrelet and the northern spotted owl, both federally listed species, and the Pacific fisher, a candidate for listing, can be found in the Elk River watersheds (BLM 2016). Freshwater streams within the watershed boundaries support production of federally-listed, anadromous salmonids including steelhead and cutthroat trout, and coho and Chinook salmon (BLM 2016, Humboldt County 2017, WPN 2003). There are five designated wildlife areas in the project watershed as shown in Figure 1-8 and described in more detail below.

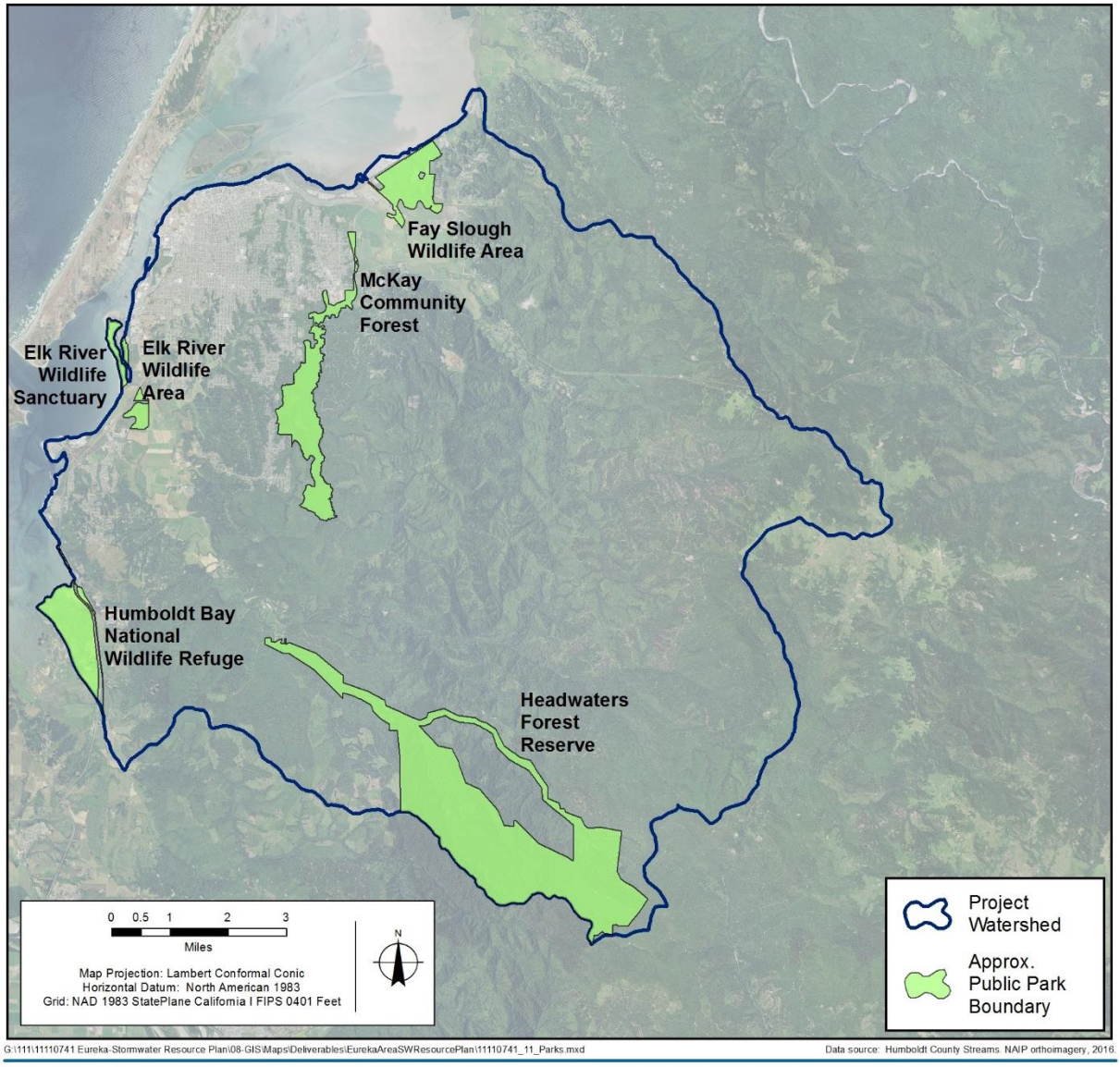

Figure 1-8. Natural and Open Spaces in the Project Watershed

1.8.1 Elk River Wildlife Area

Designated as a wildlife area by the Fish and Game Commission in 1991, the Elk River Wildlife Area is a 104-acre area that consists of coastal salt marsh and riparian wetlands. The area provides habitat for mammals including gray fox, coyote, mink, weasel and river otter (CDFW 2017). In addition to wildlife viewing opportunities, visitors can birdwatch, fish, and hunt when permitted during open seasons (California Conservation Connection 2013).

1.8.2 Elk River Wildlife Sanctuary

The Elk River Wildlife Sanctuary is located within the City of Eureka and is home to a variety of birds, sea mammals, and coast plant species including two endangered plant species: beach layia and Humboldt Bay wallflower (RCCA 2001). The sanctuary offers hiking along the California Coastal Trail, paddling along the Elk River estuary and Humboldt Bay shoreline, and bird and wildlife opportunities (RCCA 2001).

1.8.3 Headwaters Forest Reserve

A portion of BLM's Headwaters Forest Reserve is located in the Elk River watershed. The nearly 7,500 acres was established in 1999 to "conserve and study the land, fish, wildlife, and forests" (BLM 2016). The Headwaters Research Center partners with local schools such as East High School in Fortuna and Humboldt State University to conduct research on salamanders, northern spotted owls, and forest regeneration (BLM 2016). The BLM also partners with local organizations to decommission and restore former logging roads (BLM 2016). Other partnerships that assist in the management of the Reserve include CDFW; Pacific Coast Fish, Wildlife and Wetlands Restoration Association; California Conservation Corp; California State Parks; Eureka Court and Community School; Americorps Watershed Stewards Project; Americorps Youth Serve; Save the Redwoods League; and Redwood Parks Association (BLM 2016).

1.8.4 Humboldt Bay National Wildlife Refuge

The Humboldt Bay National Wildlife Refuge includes nearly 4,000 acres of mudflats, estuarine eelgrass meadows, saltmarsh, brackish marsh, seasonally flooded freshwater wetlands, riparian wetlands, streams, coastal dunes, and riparian forest (US FWS 2017). These areas provide habitat for more than 316 species of birds, 220 species of native plants, 40 species of mammals, and approximately 100 species of fish and marine invertebrates (US FWS 2017).

1.8.5 Fay Slough Wildlife Area

The Fay Slough Wildlife Area encompasses approximately 484 acres of restored coastal and seasonal wetlands. The eastern and southern edges of the area are home to red alders and willows. The area provides habitat to resident and migratory songbrids, egrets, herons, and various raptors. Reptiles and amphibians such as the northern red-legged frogs, pacific chorus frogs, northwest salamanders and newts also inhabit the area (CDFW 2017).

1.8.6 McKay Community Forest

The McKay Community Forest is located southeast of Eureka near Myrtletown, Cutten, and Ridgewood Heights within the watershed of Ryan Creek, a tributary of Humboldt Bay. Humboldt County acquired 1,000 acres of forestland from Green Diamond in 2014, and expects to acquire an additional 190 acres in 2018. The McKay Community Forest will be managed for multiple purposes including public access and recreation, timber harvest, and watershed and resource conservation.

1.9 Watershed Processes

The following sections outline the natural watershed processes that occur within the project watershed and the activities that have disrupted the natural processes within the project watershed.

1.9.1 Hydrologic Setting

The area within the project watershed boundary is unique compared to many regions in California. Unlike many areas in California, the area within the project watershed boundary has an abundance of surface water resources with average annual rainfall ranging from 40 to 80 inches. In addition to a high average annual rainfall, the project watershed is located within the Coastal Plains Heavy Fog Belt reference evapotranspiration zone, which has the lowest evaporation rates in the state (CIMIS 1999).

The project watershed includes areas of coastal climate and those of mountainous terrain. To illustrate the spatial variation in hydrologic conditions, average annual precipitation for two locations in the project watershed, as shown in Figure 1-9, were obtained from the Performance Reporting Information System (PRISM) Climate Group. The spatial variation across the watershed is also demonstrated by the 30-year normals for average annual precipitation (Figure 1-10).

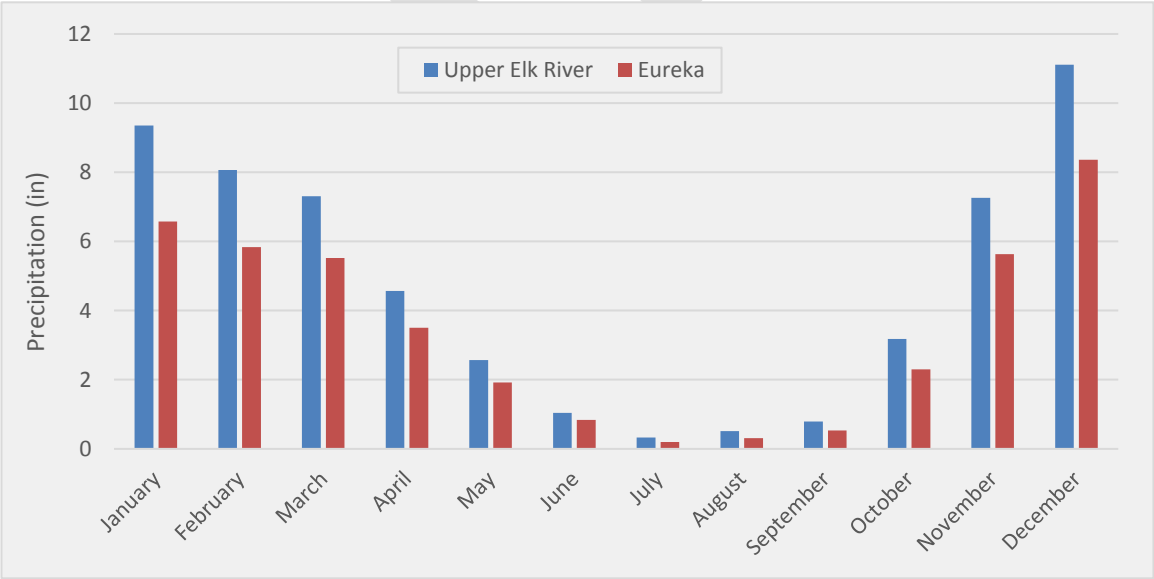

Figure 1-9. Average Monthly Precipitation for Indicated Locations (PRISM 2017)

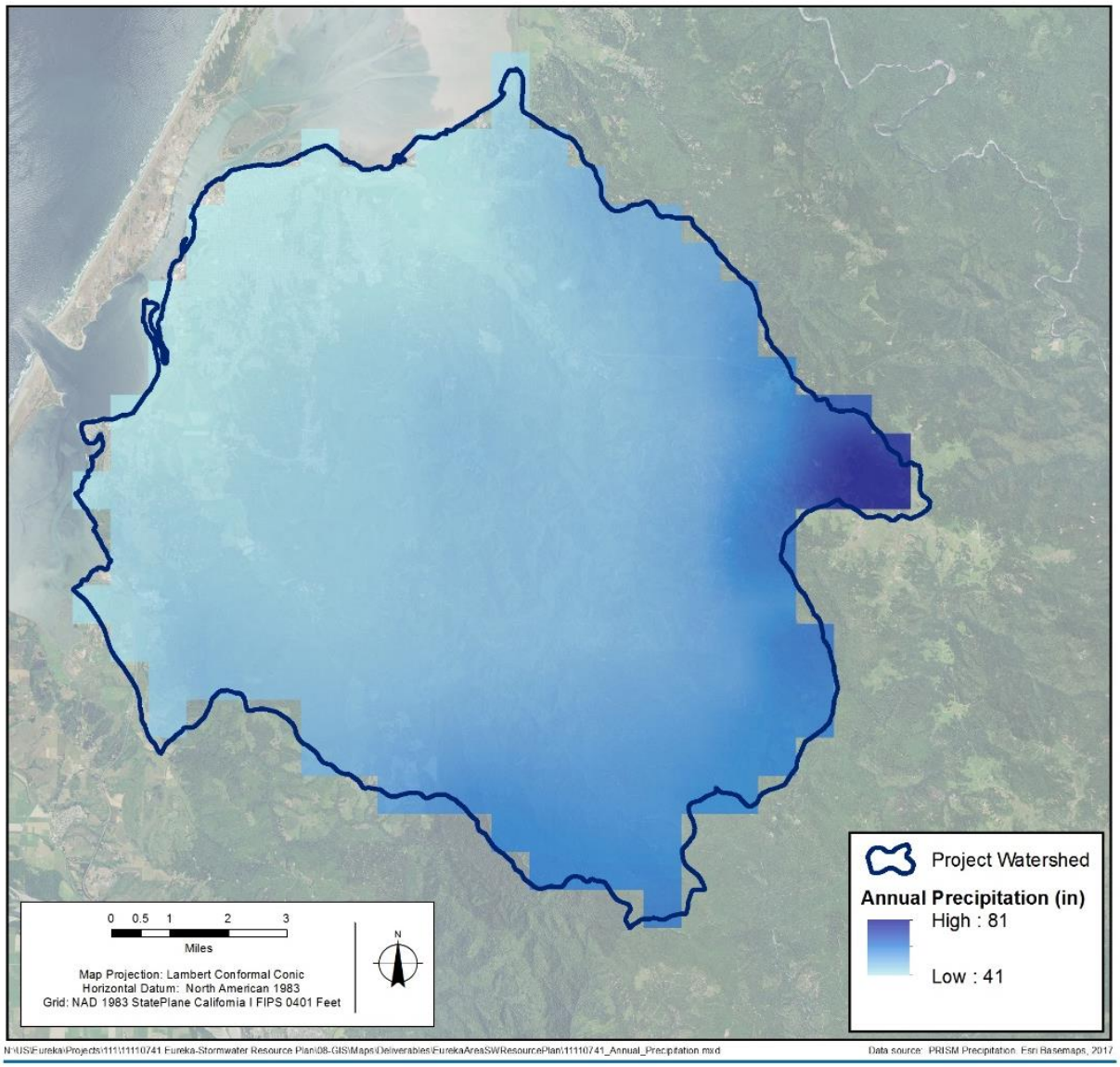

Figure 1-10. 30-Year Normal Average Annual Precipitation

1.9.2 Natural Processes

The project watershed can be divided into two regions defined by hydrologic behavior: rural areas and urban areas. The rural areas are located primarily in the upper portion of the project watershed, where the physical characteristics of the watershed (e.g., soil type and vegetation cover) dictate hydrology. The urban areas are located primarily in the lower portion of the project watershed, where stormwater flow is controlled primarily by artificial drainage networks and impervious surfaces. Precipitation in the upper portion of the project watershed either flows to a nearby surface water body or infiltrates into the ground. In the lower portion of the project watershed, water flows primarily via artificial drainage networks. In many areas, stormwater runoff cannot infiltrate into the subsurface due to high groundwater levels.

1.9.3 Interruptions to Natural Processes

Although a majority of the rural areas remain relatively undeveloped, natural hydrologic processes of the watershed have been altered due to extensive timber and road building activities, which has resulted in artificially accelerated sedimentation. The most markedly changed process within these sub-watersheds is sedimentation, which has been artificially accelerated due to extensive timber and road building activities. These activities, combined with high flow events in the mid to late 1990s, resulted in major deposition on the banks and across the floodplain, reducing the stream flow capacity and raising water surface elevations (TetraTech 2015). Increased sedimentation is evidenced by the reduction in channel conveyance capacity in the upper mainstem Elk River, which is estimated to have been reduced by a factor of 65 since 1965 (Coastal Conservancy 2013); and more frequent flooding and domestic water supply degradation in the area (Coastal Conservancy 2013, Dyett and Bhatia Urban and Regional Planners 2002, WPN 2003).

In the lower portion of the watershed, urban development and human activities that encroach upon the floodplains have affected the distribution and timing of drainage (W&K 2007). Structures and fill placement within the area reduce the flood-carrying capacity of floodplains, increase flood heights and velocities, and increase flood hazards in surrounding areas (FEMA 2015). The drainage systems within the City of Eureka have also been altered by increased impervious areas and constriction of natural water ways. Although flooding is unlikely to be prevented, proper storm water management strategies can aid in attenuating flooding within the project area.

1.9.4 Climate Change

Climate change in California is predicted to lead to increases in temperature, storm intensity, wildfires, and droughts. In the project watershed area, sea level rise (SLR) is the primary climate change factor most likely to impact storm water management. Humboldt Bay's vulnerability is unique because of the combined effects of sea level rise and large tectonic vertical motions associated with the Cascadia subduction zone (NHE 2015). The tectonic activity in the region results in the highest local sea level rise rate in California (Patton et al. 2014).

1.10 Summary of EAWSWRP Watersheds

The following is a list of key findings included in Section 1 Description of Watersheds Addressed by the EAWSWRP.

- The majority of surface waters in the project watershed are listed on the 303(d) Impaired Water Bodies List. Five distinct water bodies are included: Humboldt Bay, Lower Elk River and Martin Slough, Upper Elk River, Upper Little South Fork Elk River, and Freshwater Creek.
- Regulatory-driven pollutants, or primary pollutants, in the project watershed include sediment, trash, indicator bacteria, dioxin toxic equivalents and polychlorinated biphenyls. Common pollutants of concern, or secondary pollutants, in the project watershed include nutrients, pesticides, and hydrocarbons.

- The project watershed boundaries were determined on a watershed-scale that allows for comprehensive and integrated storm water management with a multi-benefit approach. The boundaries facilitate collaborative management amongst entities at a level higher than they have historically.
- Storm water management in the project watershed is unique compared to other areas in California due to a combination of the following: elevated groundwater levels, an abundance of surface water resources, high average annual rainfall, and low evapotranspiration rates.
- The effects of SLR will likely impact storm water management in the project watershed.

2. Water Quality Compliance

This section identifies storm water related activities that generate or contribute to the pollution to the watershed, or that impair the effective beneficial use of surface waters. In addition this section identifies linkages with Total Maximum Daily Load (TMDL) implementation plans, applicable NPDES permits, and Waste Discharge Requirements (WDRs). As discussed in Section 1.3, the two main surface waters within the project watershed, Elk River and Freshwater Creek, flow into Humboldt Bay. Water quality compliance for all three water bodies is included herein.

2.1.1 Contributors to Storm Water Pollution

The following sections identify the activities, both past and present that generate or contribute to pollution of storm water, or that impair the effective beneficial use of surface. The pollutants evaluated in the following sections were identified as one of the following: (1) a state-wide priority, (2) a pollutant that impairs a water body under Section 303(d) of the Clean Water Act (CWA), or (3) a pollutant of concern according to the City of Eureka or County of Humboldt, as presented in Table 1-2.

2.1.1.1 Sediment

Freshwater Creek and Elk River are both listed as impaired waters under Section 303(d) of the CWA due to sedimentation and siltation. Sediment in Elk River and Freshwater Creek is attributed to both natural and anthropogenic sources. Natural sources include tectonics, geology, soil characteristics, geomorphology, climate, and vegetation. Anthropogenic sources that contribute the sediment and siltation include pre-Forest Practices Act logging, ranching, farming, roads, residential development, removal of riparian vegetation, stream bank modification/destabilization, and timberlands. Sediment is also identified as a pollutant of concern by the City (W&K 2005). Within the City, sediment collects on street and other paved surfaces, and is generated from new construction.

2.1.1.2 Indicator Bacteria

Indicator bacteria is listed as pollutant that impairs the Lower mainstem Elk River and Martin Slough under Section 303(d) of the CWA. Although the exact pollutant source is unknown, agricultural, rural residential, and urban areas are all known to contribute to significant bacterial concentrations in storm water runoff (NCWQRCB 2011). More specifically, sources of bacteria include pet waste and leaky septic or sewer systems.

2.1.1.3 Trash

Trash in surface waters accumulates from intentional and accidental improperly discarded waste, thrown or deposited on land and in water bodies (SWRCB 2014). The primary sources of trash in water bodies are littering by the public, inadequate waste handling or illegal dumping via storm drain systems, and direct disposal of trash into water bodies from vessels involved in commercial,

military, fishing or recreational activities (SWRCB 2014). Conveyance via storm water is the main transport pathway of trash (SWRCB 2014).

2.1.1.4 Dioxin Toxic Equivalents

Activities attributed to generating dioxin toxic equivalents include industrial activities, including historic lumber mills, and above ground waste storage tank leaks (SWRCB 2015b). Hotspots remain from lumber mills that used the wood preservative pentachlorophenol ("penta") from the 1950s through the 1980s, when it was banned except for use on power poles. Unknown sources are also identified as contributing to dioxin toxic equivalents in the Bay (NCRWB 2010).

2.1.1.5 PCBs

Polychlorinated Biphenyls (PCBs) are listed as a pollutant that impairs the Humboldt Bay and renders it an Impaired Water Body under Section 303(d) of the CWA. Although the exact sources of PCBs in Humboldt Bay are not known (SWRCB 2015b), PCBs are often released into the environment through spills, leaks from electrical and other equipment, and improper disposal and storage. Although PCB production is prohibited, its stable nature allows the chemicals to persist in the environment.

2.1.1.6 Pesticides

Pesticides are listed as a pollutant of concern for the City of Eureka and are considered a state-wide priority pollutant (W&K 2005). Activities that generate pesticide runoff include residential and commercial use.

2.1.1.7 Nutrients

Nutrients accumulate in storm water runoff throughout the City and are identified as a pollutant of concern in the City's Storm Water Management Plan (W&K 2005). Sources of excess nutrients include fertilizers, pet waste, sanitary sewer overflows, improper restaurant practices, and excessive organic debris (W&K 2005).

2.1.1.8 Hydrocarbons

Hydrocarbons were listed as a pollutant of concern in the City's Storm Water Management Plan (W&K 2005). Parking lots, streets, automotive facilities, and illicit discharges are identified as the primary sources of hydrocarbon contamination (W&K 2005).

2.1.2 Compliance with TMDL Implementation Plans and Discharge Permits

This SWRP supports, is consistent with, and assists in, compliance with TMDLs, applicable NPDES permits and WDRs. This SWRP serves as an educational tool to inform the public and stakeholders about the watershed-wide water quality issues that persist in the project area, and how federal, state, and local regulatory frameworks aim to address these water quality issues. In addition, the EAWSWRP supports the NPDES MS4 Phase II Permit by (1) providing BMPs that aim to achieve

pollutant reduction to the maximum extent practicable from entering receiving water conveyed through MS4 areas and (2) prioritizing LID, trash capture/reduction, and sediment reduction BMPs.

Both structural and non-structural BMPs for each priority pollutant are provided in **Error! Reference source not found.Error! Reference source not found.**. In the project identification and development phase of EAWSWRP, the Humboldt County LID Manual was referenced to incorporate LID elements wherever feasible and practical. For areas in which priority pollutants are of concern, projects that promote these priorities receive additional points in the project prioritization scoring outlined in Section **Error! Reference source not found.**.

2.1.2.1 TMDL Implementation Plans

Section 303(d) of the CWA requires that states develop a list of impaired water bodies that do not meet water quality standards. TMDL Implementation Plans are required for any water body on the 303(d) list. A summary of the 2012 California 303(d) List for water bodies located within the project watershed is provided in Table 2-1.

Table 2-1. Summary of 303(d) list of Impaired Water Bodies Located Within the Project Watershed (SWRCB 2015b)

Water Body	Estimated Size Affected	Units	303 (d) Listed Pollutant	Expected TMDL Completion Date
Lower Elk River and Martin Slough	25	mi	Indicator bacteria	2025
Lower Elk River and Martin Slough	25	mi	Sedimentation/siltation	2014
Upper Elk River	93	mi	Sedimentation/siltation	2014
Upper Little South Fork Elk River	2	mi	Sedimentation/siltation	2014
Freshwater Creek	114	mi	Sedimentation/siltation	2017
Humboldt Bay	16,075	ac	Dioxin Toxic Equivalents	2025
Humboldt Bay	16,075	ac	PCBs	2025

Of the water bodies listed, only the Upper Elk River has a completed implementation plan. The Upper Elk River TMDL implementation Plan was formally adopted by the Regional Water Board in May 2016 and is currently being approved by the EPA. The plan demonstrates that the impacted reach of the Elk River currently has a sediment loading capacity of zero, which is equivalent to a zero sediment loading allocation and should be maintained until the reach's physical assimilative capacity has expanded (Tetra Tech 2015). The three key components of the first phase of the Upper Elk River TMDL Implementation Plan are (1) development and enforcement, or waiver, of WDRs, (2) completion of an Elk River Recovery Assessment, and (3) development of a Watershed Stewardship Program (NCRWQCB 2016). Together, these three components provide regulatory

and non-regulatory mechanisms to provide source control, remediation, and assessment of the TMDL.

To date, Freshwater Creek is the only other impaired water body for which a TMDL implementation plan is currently underway. A sediment source assessment was conducted in 2006 (PWA 2006); the status of the implementation plan is unknown. This SWRP will be updated as needed to incorporate actions/projects from TMDL implementation plans as they are developed.

2.1.2.2 Waste Discharge Requirements and NPDES Permits

The Federal Storm Water Phase II Rule requires operators of small municipal separate storm sewer systems (MS4s) to obtain a National Pollutant Discharge Elimination System (NPDES) storm water permit. The Phase II Rule is the follow-up to the EPA Phase I NPDES Program, promulgated in 1990 as part of the Clean Water Act. The North Coast Regional Water Quality Control Board (Regional Water Board) is the regulatory agency having Phase II NPDES permit oversight authority for the City and County. The State Water Resources Control Board issued a WDR General Permit in 2003, which was re-adopted with new requirements in 2013. In 2015, Trash Amendments, which apply to all Phase I and II permittees under the NPDES MS4 permits, became effective. The City of Eureka selected Track 1 and County of Humboldt selected Track 2. MS4s that select Track 1 must install, operate and maintain full capture systems in storm drains that capture runoff from one or more of the priority land uses. For Track 2, MS4s must implement a plan with any combination of treatment controls, institutional controls and /or multi-benefit projects within jurisdiction that result in the same performance results of Track 1.

In addition to the General Permit, applicable WDRs and NPDES Permits within the project watershed include:

- Order No. R1-2016-0004: Waste Discharge Requirements for Nonpoint Source Discharges and Other Controllable Water Quality Factors Related to Timber Harvesting and Associated Activities Conducted by Humboldt Redwood Company, LLC in the Upper Elk River Watershed, Humboldt County
- Order No. R1-2013-0005: General Waste Discharge Requirements for Discharges for Timber Operations on Non-Industrial Timber Management Plans (NTMP) in the North Coast Region.
- Order No. R1-2014-0011: Categorical Waiver of Waste Discharge Requirements for Discharges Related to Timber Harvest Activities on Non-Federal Lands in the North Coast Region
- Order No. R1-2016-0001: NPDES NO. CA0024449: Waste Discharge Requirements for the City of Eureka Elk River Wastewater Treatment Plans, Humboldt County
- Order No. 2015-0023: Waiver of Waste Discharge Requirements and General Water Quality Certification for Discharges of Waste Resulting from Cannabis Cultivation and Associated Activities or Operations with Similar Environmental Effects in the North Coast Region

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